

Accelerator Systems Division Highlights Ending December 12, 2003

ASD/LANL: Warm Linac

HIGH-POWER RF (WBS 1.4.1.1)

Accomplishments This Week: (1) *805-MHz, 5-MW Thales klystrons:* We installed the second 5-MW klystron into the test stand and started conditioning. We received the third 5-MW klystron and successfully factory tested SN 5 at the vendor. (2) *805-MHz, 550-kW Thales klystrons:* We received the first two 550-kW klystrons (SN 2 and 6) from Thales. (3) *805 MHz, 550 kW CPI klystrons:* We approved the test data for SN 42. (4) *SC Transmitter:* Commissioning of the first SCL transmitter is nearing completion at ORNL. Commissioning of the second transmitter is in progress.

HIGH-VOLTAGE POWER CONDITIONING (WBS 1.4.1.2)

Accomplishments: (1) We completed inspection of the prototype HVCM. We made a design change to the tank lid (unique to the prototype) and moved the unit back into position. (2) We completed a test plan for the SCL HVCM commissioning at ORNL.

DRIFT-TUBE LINAC (WBS 1.4.2)

Accomplishments: (1) Twelve Tank-2 drift tubes and one each for Tanks 5 and 6 passed final inspection and were shipped to ORNL on Friday. They are scheduled to arrive on Monday, 12-15-03.

Issues and Concerns: One BPM drift tube developed a short in one of the cables and is being sent back to LANL for diagnosis and repair (see below under Diagnostics).

COUPLED CAVITY LINAC (WBS 1.4.4)

Accomplishments: (1) N. Bultman, J. Billen, M. Collier, and D. Ireland remained at ORNL for a second week to lead installation and tuning of CCL Module-1. All segments (1–12) are now tuned and mounted (see Fig. 1). (2) All Module-2 segments except #4 are now tuned and mounted on the girder at ACCEL. They are scheduled to have the final segment mounted and all sub module tuning complete by Dec. 19, just before the holiday break.

Concerns & Actions: In our weekly management conference call, ACCEL remained optimistic they could meet the 3/29/04 Module-4 delivery date. However, we are concerned about the manpower being applied and their detailed schedule tracking. We scheduled a progress review by the ASD Division Director and LANL STL on 12/19/04. By that date, we expect to see Module-2 completely assembled and ready for bead pull measurements, and the stack braze completed on four Module-3 segments.

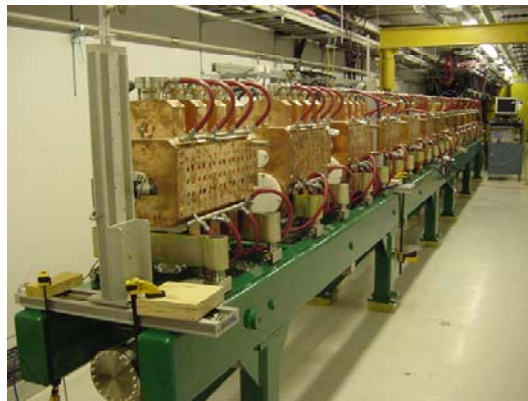


Fig. 1. CCL Module 1 installed at ORNL (left) with assembly team (right)

PHYSICS & DIAGNOSTICS (WBS 1.4.5)

Accomplishments: (1) *BPM pickups:* DTL BPM drift tube 2-3 has been accepted dimensionally and turned over for final processing. DTL BPMs 2-3 and 3-8 are still at LANL (in final processing) and should ship next week. (2) *BPM electronics:* Testing continues in preparation for shipping 12 BPM electronics systems to ORNL. Eleven of the system motherboards have passed the tests. Following full system tests they will be shipped next week. (3) *Wire-scanner pickups:* Two six-inch (DTL) actuators are ready to be shipped to ORNL; another one is being tested,

and the fourth (and final) is being assembled at Huntington. We also have one three-inch (CCL) actuator under test at LANL with seven more expected from Huntington within a couple of weeks. All actuators have been cleaned and leak checked and will be shipped with attached travelers. To protect the forks we propose to ship the actuators without the forks and mounting flanges assembled to them. (4) *Wire-scanner electronics*: The 23 computers from Rackmountpro arrived at ORNL this week. We now have all of the computers that we need for the entire build at the site. Nine wire-scanner Electronics and Motion Control systems will be shipped this week (see Fig. 3). This completes the planned shipment for the HEBT that was scheduled for the end of December. Wynn Christensen is planning to travel to ORNL in January to lead in integration of these systems. (5) *RTBT wire-scanner electronics*: We have received the bare PC boards from the vendor. We are in the process of getting bids for mounting the parts and putting together part kits for this activity. Our goal is to select a vendor and ship the parts to then before the holiday break. (6) *Energy degrader/Faraday cup*: The final five ED/FC actuators (4 DTL, 1 CCL) are now at LANL for final testing with the ED/FC electronics before shipping to ORNL (see Fig. 2) (7) *RTBT Harp*: We held a design review for the harp this week. Basically there were no showstoppers. The circuit trace on the ceramic is a proven rad-hard, robust design that has worked very well at LANSCE. We are working on finding other suppliers that we hope will reduce the cost of the boards. John Power will perform a SPICE modeling of the board before fabrication starts.

Concerns & Actions: ORNL found a shorted lead on the top lobe of one of the DTL Tank-6 BPM pickups and is shipping this drift tube back to LANL for evaluation and repair. This drift tube passed all tests and mapped successfully just prior to the final stem plating and ultrasonic cleaning steps in the processing.



Fig. 2. Energy degrader/Faraday cup for DTL ready to ship to ORNL



Fig. 3. Final linac/HEBT wire-scanner chassis ready to be shipped to ORNL

ASD/JLAB: Cold Linac

Three additional cavities (two medium- β , one high- β) were qualified this week. This completes the cavity requirements for the M-10 string.

Due to the gap in the cryomodule testing schedule created by the problem with M-7 (see below), the M-4 cryomodule is being prepared for installation into the cryomodule test cave.

Cryomodule M-5 is being prepared for shipment to ORNL.

The insulation vacuum leak in the M-6 cryomodule has been isolated at an instrumentation feedthrough that seems to have been poorly welded into the return end can by the vendor. Repairs are underway.

The M-7 cryomodule insulation vacuum failed on first cooldown. The module has been removed from the test cave for repair. Attachment of end cans to all future modules will not take place until the end cans have passed a series of cold shocks, to avoid having to make this type of repair again after cryomodule assembly.

The M-8 cryomodule cold mass has been assembled and transferred to the space frame. Tooling has been passed back to the cavity production group for assembly of the M-10 string, which is planned for early January. Assembly of the M-9 string is complete. It is being evacuated.

ASD/BNL: Ring

The SNS Project Office held a video-conference with BNL/SNS management and staff on FY04 and FY05 funding, work packages and schedules.

A message from Roger Connolly to BNL/SNS staff earlier this week:

“Here is a selection of IPM measurements over the past week in RHIC. It appears that the design is solid. The SNS detector should be even better as there are a couple of noise isolation features we are adding to SNS that will be incorporated into RHIC detectors during the next shutdown. I believe that the most important measurement in the SNS ring is the uniformity of filling phase space during injection. Only an IPM can give this information.”

New England Technicoil (NETC) reported the shipment of their last three (3) 27CD30 production magnets to SNS/OR. (This production run is now complete.)

Vacuum beam tubes for Ring collimators #2 and #3 have been TiN coated at BNL and shipped back to SDMS for final assembly.

BNL/SNS technicians are working on the next two half-cells. Half-cell #15 will ship next week (Tuesday) while half-cell #16 will ship in late December or early January.

Approval has been received from BNL Safety for load testing the new half-cell lifting fixture. Work planning is underway to begin testing next week.

Power supply production - the 4000A, 18V power supply has been approved and authorization given to IE Power to ship the unit to SNS/OR.

Twelve (12) Lambda power supplies (charging, RF) and thirteen (13) thyratrons (switch tubes) were shipped from BNL to SNS/OR this week.

Magnetic Measurements:

- 30Q58 - transfer function measurements are underway. Six have been measured; the remaining six should be measured by the end of next week. Limited statistics are encouraging.
- Injection septum magnet (spare) – the excitation curve (TF) is done. We will measure fringe field next week.

BNL travel:

- Wahfun Eng is at IE Power for final acceptance of two injection bump power supplies.
- McGahern visited Ranor, Inc. for pre-production meeting on R2 and R3 collimator outer shielding.
- McGahern visited NETC for pre-delivery inspection of the injection dump septum magnets.
- Charlie Pearson was at SNS/OR for a design meeting with Mike Holding on the RTBT radiation hardened quads and interface issues.
- Ain-Lin Mi was at APS for the shipping approval of the first article PFN assembly.

Controls

Installation

Craft Snapshot 12/9/03

ASD craft workers	53.0
Foremen (Pd by 15% OH)	6.0
AMSI management (Pd directly)	3.0
TOTAL AMSI WORKERS	62.0
Less WBS 1.9, 1.2 etc	8.0
Less absent	4.0
TOTAL BD BY ASD/ORNL DB WP	41.0

Discussion of the ASD Priorities and SRO summary status has been added to the Friday Morning Installation Meeting Agenda. This further integrates the Friday Morning Installation Meeting with the Division Director's Weekly Installation Meeting.

The RF Group Leader, Ray Fuja, presented an updated Installation schedule for the rf systems against the IPS milestone SC 320 SC & CCL 4 Start System Test with Beam (1st Beam) date of 11MAR05. It shows that SCL_ME05 must be completed in FY04 to meet this date. An action item was generated to present an integrated plan to the 09JAN04 Division Director's Installation Meeting.

Operations Group

Held a Lessons Learned Meeting on DTL Tank 1 Commissioning

Worked on DataStream 7i implementation

Continued with revisions to the Operations Procedures Manual

Prepared a proposal for the ORNL-HBCU Summer Program

Worked on the ASD laboratory plan for the CLO

Worked with ASD Controls on PVs and save sets and save set applications, Archiver, and Alarm Handler

Accelerator Physics

Work continues on the physics applications needed for ring commissioning. The Jython code to determine the rms emittance in the HEBT beam line from wire scanner profiles is being incorporated into the controls framework, and progress continues on the loss monitor application.

We received from Xiaobiao Huang the Orbit Response Matrix scripts and codes he developed for the PSR. We plan to adapt these for use at the SNS.

Ion Source Group

Electric shutoff valves have been installed in the air and cooling water supplies for the Ion Source Hot Spare Stand. This allows one following the "Emergency Shutdown procedure" to switch off the cooling water and the compressed air to the Hot Spare Stand without having to enter the Hot Spare Stand cage. This may be needed when a hose breaks loose when no ion source personnel are present. Switching off the air and/or water will automatically switch off the RF and ion source high voltage.

Significant progress has been made with the EPICS controls of the Hot Spare Stand, an effort currently spearheaded by Alan Justice. He has implemented the control of the 2 MHz driver amplifier and several readouts from the 2 MHz power amplifier. In addition he has reestablished the control of the 13 MHz amplifier and the Hydrogen flow

controller. He is currently working on controlling the e-dump supply and the 2Mz pulse generator. Some of the controls, however, have been seriously upset by sparks, and therefore they have been temporarily removed.

Survey and Alignment

Mechanical Group

Drift tube processing continues. We now have 165 of the 210 drift tubes in-house and are working rapidly to run them through our pre-installation checks which include fiducialization, magnet mapping, and leak testing. We are receiving new ones regularly.

All drift tubes for DTL4 have been installed! We are planning to begin the alignment first thing Monday morning.

The downstream DTL1 endwall has been removed and the 4 dummy drift tubes removed in preparation for the new EMD tubes.

The endwalls of DTL3 have been removed and sent to the machine shop to be modified per the new drawings. All 6 drift tubes have been removed in preparation for the new EMD and BPM tubes to be installed.

We are receiving shipments almost daily of components for DTL assembly and these are parts for tanks 5 and 6 drift tube assemblies.

The tuning of the bottom coupling cavities of the CCL-1 segments is complete. The segments have been set on the support stand, aligned, and the bridge couplers installed. Bead pulls will begin today and preparations for leak testing will begin next week.



CCL-1 Bridge Coupler Installation



CCL-1 Tuning Team



CCL-1 Installation Team

Water Systems Installation

- Installation of piping from TRCC-03 cart to the RF equipment was finished; this completes $\frac{1}{2}$ of SCL ME-02 piping.
- Installation of DI water piping from the CF headers to the SCL ME-02 HVCM was started.
- Installation of DI water piping from the CF headers to the SCL ME-02 TRCC-04 skid was started.
- Installation of DI manifolds to all the CCL power supplies was completed.
- Installation of piping to the CCL-01 klystron was started.
- Fabrication of the QMCS piping manifold in the Linac continued.

Ring Systems Installation

- The HEBT momentum collimator base final grout pour was completed.
- The HEBT 21Q40 Magnets' stands were grouted.
- Installation of the DC corrector magnet cables from the Ring Service building to arcs A&D continued.

Magnet Task

We have now mapped 20 DTL EMD's.

We also finished mapping another HEBT 21Q40. The spread so far in transfer function of these 21Q40's is 0.5%. We are trying to find the source of this spread which should be 0.1% or less.

Electrical Group

Klystron substation KL-SS2 ASD AC installation inspected and released for operation to support SCL testing schedule. This is only a partial release, since the KL-SS2 installation is not complete.

Magnet cabling in the ring tunnel quadrant B and C completed, mechanical half cell installation commenced.

Operation of DTL-ME3 and the RFTF HVCM continues at maximum achievable average power for each system. No trips related to HVCM subsystems have occurred. Checkout of CCL-ME2 continues, with this week spent checking interlocks and equipment protection features. We should be ready to start checkout with high voltage sometime next week. The reconfiguration of the SCL-ME1 control chassis occurred successfully, and we now have a new start pulse configuration on this system consistent with circuit simulations which should substantially reduce IGBT switching losses. Everything is ready for operation of this system into a klystron load on Monday. We performed a thorough inventory of HVCM equipment at ORNL, and have identified several outstanding deliveries from Dynapower.

Tested 12 more corrector supplies (for a total of 221/356).

Tested the first 2 SCL power supplies.

HPRF

SCL ME1 is ready for HV, 2-transmitters have been checked out the HVCM has been run into a resistive load, Waveguide is attached to 12 klystrons, epics control of transmitters has been checked, shorts are in place on the waveguide in the tunnel and are tagged, so on Monday the 15th HV will be applied to 12 Klystrons if all goes well RF checkout will begin.

The Thales 5 MW tube was trial fit with the lead X-ray shield to allow engineering of the water fitting interface.

The first two SC transmitters (MB-1/2 and MB-3/4) passed a comprehensive on-site check out procedure and the twelve associated 550 kW klystrons are now ready for high power testing starting next week.

LLRF

Hengjie Ma and Craig Swanson are at LANL working with colleagues to solve the VXI buss data transfer problems. As reported by LANL:

“Accomplishments: (1) We delivered the complete and final documentation for the production of the HPM boards to ORNL. The CAD drawings and the bill of materials we placed on the ORNL FTP site. We are also finalizing similar documents for the FCM boards. Those should be ready early next week. (2) Engineers from ORNL visited LANL this week to help with resolving a problem with high-speed access to the history buffers in the FCM module. As reported previously, this problem has not interfered with the phase and amplitude control functionality of the LLRF system that is in use with the DTLs. ORNL and LANL engineers finally tracked the problem to a firmware bug in the timing utility module and demonstrated full system functionality after fixing the problems. The LLRF system is currently in the state of no known problems.”

Subsequent to their report, it was determined that the High-Power Protection Module (HPM) is also causing buss errors. This is under investigation and will likely be resolved in the next week by means of a code change.

The Analog Front End (AFE) requisition is in procurement and should be finalized next week.

The HPM requisition is in procurement and will be finalized after resolving a few contractual issues.

The requisition for the VXI motherboard, DFE and RFO will be submitted to procurement next week.

Quotes have been received for production of the intra-module RF cables for the Field Control Module (FCM); a requisition will be submitted to procurement next week.

We have been busy finishing up the installation and checkout of the provisional LLRF system for SCL klystrons 1-12 so that testing of the associated transmitters and HVCM may proceed.

Installation of the hangers in the tunnel for the 805 MHz reference line is in progress and nearing completion. The CCL installation team informed us this week that if the reference line were already installed, there would be interference between the reference line and the crane that is being used for CCL assembly. This will not be a problem for CCL1 since we do not expect delivery of the reference line until February. Installation of CCL2-4 and installation of the reference line will have to be coordinated to minimize schedule delays.

Cryosystem Group

CHL

- The purifier is operating to clean the recent delivery of 100,000 cubic feet of helium.
- We have started to clean helium storage tank number 6
- The top plate has been removed from the 2.1K cold box to gain entry so the shipping braces can be removed.
- We are checking the alignment of the motor to compressor couplings.

The leaking bellows in module # 4 has been replaced and we are pumping down the transfer line to perform a leak test.

Work continues on the fabrication of the Cryomodule “U” tubes.

Beam Diagnostics